Saskatchewan
Agriculture
and Food

ADF

AGRICULTURE DEVELOPMENT FUND

FINAL REPORT

20020174

PRE-COMMERCIALIZATION TRIALS FOR A LONG LIN FIBER FLAX BASED INDUSTRY IN SASKATCHEWAN

Funded by: The Agriculture Development Fund

March, 2006

Prepared by: Biolin Research Inc.

Pre-Commercialization Trials for a Long Line Fiber Based Industry in Saskatchewan

Final Report

Biolin Research Inc.

Submitted to
The Agriculture Development Fund
of
Saskatchewan Agriculture and Food

Regina, Canada

March, 2006

Project: 20020174

Project Title: Pre-Commercialization Trials for a Long Line Fiber Based Industry in Saskatchewan

Final Report

a) Summary

During the 2003 and 2004 growing seasons Biolin Research Inc. performed field research into the agronomic performance of 12 fiber flax varieties and the suitability of European field equipment for the production of Long Line Fiber Flax (LLFF) in Saskatchewan. Results of this research demonstrated that all 12-fiber flax varieties tested performed well, however, it is important to note there were performance differences between varieties and locations in the province. The European LLFF field equipment performed adequately in Saskatchewan conditions to produce aligned straw suitable for producing long line fiber. Improvements to field machinery and management can enhance the expected future returns to LLFF in Saskatchewan.

b) Technical Report

Biolin Research Inc. of Saskatoon, Saskatchewan carried out agronomic trials on fiber flax varieties at five sites in eastern Saskatchewan in 2003 and 2004. The purpose of these trials was to provide physical data and production experiences that to assess, conclusively, the potential for Saskatchewan as a supplier of Long Line Fiber Flax. The results of this study can lead to greatly expanded development and commercialization activities that will eventually usher a firmly established flax fiber industry on the prairies. In addition, this study has led to significant modifications to the LLFF equipment used in these trials and to the improved field management expertise of people running the trials.

The flax straw from these trials was tested for fiber content using near infrared (NIR) and manual methods developed by Biolin in previous ADF projects. These tests showed that variety and location can have significant affects on fiber content.

All farmers and field managers were very interested in the beginning but when it came to seeding, spraying and harvesting, they had little time to spare. Unfortunately in this trial, this is when their participating was most needed.. Although cooperates said they would pick land that had few or no weed problems and a minimum of trash, Biolin staff would go out to plant plots and find a trashy, weedy, lumpy seedbed. Research stations at Indian Head and Redvers had extremes of growing season weather and/or changes in staff that were detrimental. The research station at Melfort had the best seedbed conditions and weed control and correspondingly the highest yields of straw and fiber.
Appendix A shows the summarized data results of the variety (small plot) trials
Appendix B shows the summarized data results of the acre plot trials.

Unfavorable weather (e.g., hail, frost, wind) and/or poor performance on the part of some of the ccooperatants constranted the quantity and/or quality of the straw that was produced. The following is a brief summary of these types of problems and how they might be mitigated in the future.

Canora 2003

Growing season conditions were close to normal in Canora in 2003.

Problems

Lots of thistles, hemp nettles, buckwheat and Canola in variety trials. Lots of grassy weeds in retting trials. Short spaces in the rows in variety trials. Cleavers and buckwheat present in acre trials.

Mitigating Measures That Might Be Employed

Consistent seeding method (i.e., all trials seeded by French drill) to reduce the bias between the variety trials and acre trials. Weather had an affect on the weeds, but better weed control practices would be advantageous.

Churchbridge 2003

The field had been pre-worked and the soil was very lumpy. The cultivator furrows should have been harrowed to reduce lumps and leave the field smooth. Because of the furrows some seed shoes were unable to penetrate the soil leaving the seed on top of the soil. Germination was spotty. There seemed to be patches of root rot[1], which greatly reduced yields. Growing season conditions were close to normal but turned dry August and the flax straw did not rett in the 2003 fall.

Problems

The field had been cultivated, the soil was very lumpy and deep furrows from the cultivator, these furrows would allow the seeder shoes to ride in the furrow without placing some of the seed into the soil. There was what appeared to be areas that seed did not germinate, or very sparsely at the least. Herbicide damage to flax. Volunteer Canola, and cross-seeded oilseed flax.

Mitigating Measures That Might Be Employed

Harrowing in the opposite direction of the cultivator would help to make an even soil bed. A packer or more efficient harrow needs to be developed to make seeding into furrows more efficient. Researching previous year field treatments would help to pinpoint germination problems due to treatment of the soil in the previous year

Indian Head 2003

There was less than 15 mm of precipitation in the growing season and the flax had to get by on spring moisture. The acre plots were harvested only for seed due to the lack of height and low plant counts (it is remarkable that seed was even produced given the drought conditions).

The small plots were slightly taller than the acre plots but stems were not as even because they were seeded in a narrow plot pattern instead of the ribbon-like seeding pattern used in the acre plots.

Problems

Very dry year, which was not a good combination with the clay soil. Trials were seeded on an uneven, declining to one side, land. Emergence was good, but stem diameters were not even. Trials were seeded into heavy stubble.

Mitigating Measures That Might Be Employed

Wider spread pattern of seeding would offer the opportunity to increase the seeding rate, making the stem diameters more even.

Preeceville 2003

Plant growth observations suggested a nitrogen deficiency may have occurred. There was a late thistle infestation as well.

Problems

2003 was an unusually dry year. The land was not prepared and Biolin staff had to use a small discer provided by the farmer with no harrow. There was an abundance of trash from previous year, and cultivating was not sufficient to work the trash in enough. Small plots were difficult to plan with the French drill, and the replicates were set out too close together to allow proper room to maneuver between. Emergence was spotty. Lots of thistles.

Mitigating Measures That Might Be Employed

Selection and preparation of land in the fall would help deal with the trash problem. Preplanning, with the knowledge of the field being seeded with the French drill, will allow proper replication maps to be made. More nitrogen and better weed control would have helped.

---

[1] No plant pathologist or crop specialist was able to explain, with certainty, the cause of these distinct stained yellow areas of flax within the plots. A local farmer thought it was caused by the growth inhibiting residues created when quackgrass patches are sprayed in the spring with "Round-Up" before seeding and the rainfall is insufficient during the early growing season to dilute and flush this resude below the rooting zone of flax.

Redvers 2003

Redvers had almost no rain after the end of July. This limited fiber deposition and retting. The flax straw did not ret in the fall of 2003

Problems

2003 was an unusually dry year. Trials were seeded in a soil that had gravel content. Pulled straw in rows were blown into piles by big winds.

Mitigating Measures That Might Be Employed

Selection and preparation of land in the fall would help deal with the trash and soil type issues.

Abernathy 2004

Variety trials had some weeds in plots and the stand was much thinner than normal due to fertility problems early in the growing season.

Problems

No nitrogen application.

Mitigating Measures That Might Be Employed

Better fertilizer management.

Churchbridge 2004

Hail damage in early August (a crop adjuster from Crop Insurance assessed a surrounding field at 20% loss) caused some bruising on seed bolls; however, the stems survived. There were uneven heights throughout the field; and frost on August 20th had a negative impact on seed maturity. There appeared to be two different growth stands in every trial.

Problems

2004 was an unusually dry year. Hail and frost damage, two different plant stands, possibly due to a dry beginning and a late rain. Pulled straw in rows were blown into piles by big winds in late September.

Mitigating Measures That Might Be Employed

Take out crop Insurance.

Melfort 2004

The plots in Melfort were the most even of all the five sites and were seeded in summerfallow. There was excellent emergence. The flax in the acre plots was slightly shorter than would be desired. The colder than normal growing conditions in late June and early July are likely responsible for the flax being slightly shorter than normal.

Problems

Retting conditions were not favourable in fall 2004; straw had to be baled in spring 2005.

Mitigating Measures That Might Be Employed

Seeded into summerfallow in early May, if possible, to give plants longer time to mature. The Melfort area is generally cooler and wetter than more southerly and western areas thus, crops tend to take more days to mature. If

fiber flax is seeded in the Melfort area, it is probably best to seed in early or mid May on cereal stubble with not more than 40 kg/ha of actual nitrogen fertilizer applied.

Preeceville 2004

The seedbed was not adequately prepared by the farmer co-operant. The flax was seeded into cereal stubble and there were trash piles in the field. The French drill was not suitable for seeding in high trash conditions. The trash piles blocked and skipped the seeder, so there was patchy emergence in the acre trials.

Problems

The land was not prepared so Biolin staff had to use a small discer provided by the farmer with no harrow. There was an abundance of trash from previous year, and cultivating was not sufficient to work the trash in enough. Emergence was spotty. Lots of thistles.

Mitigating Measures That Might Be Employed

Selection and preparation of land in the fall would help deal with the trash and thistle problem.

Redvers 2004

A plow wind in September rolled and tangled the pulled straw into big piles. Consequently the straw did not ret.

Problems

The original land determined by the farmer was not prepared and after visual inspection by Biolin staff, was not the requested size. The land used for our trials was not prepared and Biolin staff, along with the farmer, had to prepare the land before seeding. Due to time and money constraints the rough and trashy land had to be prepared and seeded within two days (there were three people with trucks and trailers there and that would have been expensive to have them return later to seed). Trials were seeded into very moist land, 5 days after 12-inch snowfall. Farmer maintenance of plots was minimal, trials were weedy, and no mowing was done between the plots.

Mitigating Measures That Might Be Employed

Selection and preparation of land in the fall would help deal with the trash and soil type problem. More formality (signed contracts), accountability and enforcement of land agreements is needed.

Performance of LLFF Machinery

This project utilized four different used (not new) machines to produce LLFF. These consisted on an eight foot wide French model seed drill, a five food wide Russian pull-type flax puller, a single row self-propelled French Dehondt flax turner and a single row French pull-type Dehondt baler. The following paragraphs contain brief descriptions of the experiences with these machines. It should be noted that the seeder, puller and turner are especially "small" in comparison the capacity of most farm machinery in use in Western Canada. However given LLFF is a potentially high value crop it is not surprising that the management requirements are, in many ways, more similar to a horticulture crop than to a broad acre feed crop.

The puller, turner and baler cannot be run when the straw is moist. In our experience, if the straw is moist, the puller cannot grip the straw to pull it out of the ground and the straw catches in the machine, the turner bunches the straw rather than feeding it through in an even row, and the baler belts won't turn the bale as it is being formed in the chamber.

Seed Drill

The Nodet Company makes a variety of seed drills that can be used for many crops. The model used for this research was designed for a three-point hitch and built like a light hoe drill with two rows of three inch shovels spaced six inches apart.

The shanks are mounted with light springs such that the shovels follow the contours of the ground closely and will travel up and down over cultivator ridges. When the seed falls down the seed boot, it spreads quite well throughout the three-inch row produced by the shovel. The shank spacing, shovel width and seed spread patterns give approximately 50 % seedbed utilization. Unfortunately the close shank spacing does not allow much trash (i.e., straw) clearance and hence this drill only works on land that has little or no trash. This presented a problem in plots where cooperants failed to incorporate the straw the fall before and/or to drag the straw off in the spring.

By blocking off several of the seed "runs" we were able to modify the seeder such that it could seed two plots 1.2 meters wide, at the same time. The advantage of doing this, relative to a typical double-disk drill plot-seeder was that it produced a much better distribution of seed. The disadvantage was that it was harder to get an exact seeding rate.

The drill was initially equipped with two rows of tine harrows following the shovels. This configuration was used in 2003. After the crop emerged in 2003, some unevenness of emergence in lighter soils was noticed, thus, in 2004, a very light packer wheel system was fabricated to replace the harrows. Emergence in 2004 appeared to be improved over 2003 (the spring of 2004 was also wetter than the spring of 2003). Following the 2003 season, a set of planks behind the seed box were attached so that it was easier to fill the box with seed and to ride along and monitor the seed supply in the seed cups while small plots were being seeded.

This drill is small and would be impractical for large fields in Saskatchewan; however, it is very good for small plots and small fields with little or no trash. Both the seed distribution pattern and the consistency of the depth of seeding were excellent (i.e., either all the seeds emerge or none emerge).

Puller

The Russian manufacturer has been making this model of flax puller for many years with little or no design changes. Since it is Russian and is pull-type, it does not perform as constantly as the French or Belgian self-propelled pullers. However, the Russian equipment cost less than 25% the price of single row French or Belgian model. The Russian puller pulls flax from a five-foot width and lays it in an aligned row to the side of the machine. This means that approximately fifteen feet of fallow-like space around the edges of the field is required for the first pulled rows have bare ground to fall onto. In the case of Belgian and French self-propelled machines, such bare space around the field is not necessary because the aligned pulled rows fall behind the machine instead of to the side of the machine. In addition, the French or Belgian self-propelled machines pull four feet (one row) or eight feet (two rows). Since the Russian puller pulls five feet instead of four, the layer of pulled straw from the Russian puller is 5/4 or 25% thicker than the layer produced by the Belgian or French puller. A thicker layer is positive in that it leads to better separation between adjoining rows but it is a negative (relative to a thinner layer) in that it is harder to have consistent sun bleaching and moisture content (and hence more chance of green color steaking and/or uneven retting).

After an initial trial with the puller, an offset hitch was fabricated to better accommodate making sharp turns with a tractor that has wide back wheels. A windscreen for the front of the deflector shield was installed so that flax could be pulled on windy days. Several small deflector shields were also added so as to limit the chance of the straw catching on the front of the big deflector shield. The "deseeder" (a spike cylinder, shields and pulleys) and seed boll conveyor system were removed since they were not being used and pulled straw would sometimes hang up on them. A plank platform at the back of the puller was added so someone could ride along, if necessary, to monitor machine operations. Several of the puller belts broke. These were challenging to repair and/or replace because of their profile and the fact that few other types of machines in Western Canada use belts with such a profile. Although the Russian puller is not as convenient or consistent as Belgian or French self-propelled models, it is still an interesting option because of its much lower capital cost.

Turner

When the turner was first used, in 2003, it often plugged and/or dropped the straw in bunches. Attempting to alleviate this, operating it at different speeds was tried speeds, as it the speed of the feed is according to the speed of the unit, but it did not help. Unfortunately there was no other flax turner to compare it to. We eventually realized the whole front of the turner frame had been bent (perhaps during shipment on in an accident in Europe). Initial re-bending of the frame in 2003 after the

first two fields were turned and further re-bending in the summer of 2004 appears to have corrected this problem. As well, a seat belt was added to improve safety.

Baler

The Dehondt pull-type round baler used is similar to the common round balers used in Western Canada except:

1) the bale chamber is only four feet wide instead of the more common five or six foot widths
2) the belting in the bale chamber is coming from a four or five foot width of crop instead of twelve to thirty foot width hay or straw windrows
3) the pick-up does not have teeth going completely to the edge of the pick-up so there is less chance of snagging straw from the next row of pulled straw
4) there are two adjustable width "arms" that insert twine between the layers of straw as the bale is formed as well as wrapping the bale with twine after the bale is formed instead of just one arm wrapping the straw after the bale is formed.

We had some problems with the gearbox that moved the pick-up teeth. New gears appear to have solved the problem. Repairs to some broken fins within the pick-up improved pick-up performance. There were problems with the twine cutters consequently, adjustments were made s, which appear to have helped, but there still are times when the twine does not cut properly.

The baler works most effectively when the straw is 3 to four feet and the operator picks up the straw in a large 'zig-zag' pattern. If the straw is not more than three feet, or has a large abundance of seed bolls and heads, the baler tends to bunch on one side and the bale comes out looking more like a cone than a tube.

c) Personnel

The following is a list of personnel involved with this project that have received salary or wages

Table 1 - Salary Breakdown (2004)

	Time Spent	Fees/ Salaries/Wages Paid
Allison Braun	2.1%	$347
Sherry Fehr	1.9%	$308
Gary Koop	18.3%	$5,324
Jessica Reimer	8.2%	$1,539
Aseem Sharma	0.5%	$83
Prem Sharma	7.5%	$1,395
Simons, Kevin	21.0%	$4,808
Delmar Rempel	11.1%	$4,606
Lorne Hanson	5.9%	$1,104
Cowan, Randy	18.2%	$6,046
Richard Marleau(Consultant)	1.5%	$645
Alvin Ulrich(Consultant)	5.5%	$3,237

d) Equipment

No equipment was purchased with project funds. However, tractors, trailers and trucks were rented so as to operate the rented seeder, puller, turner, and baler.

e) Project Developed Materials

To present the flax trials to the interested public during field days, signs and informational brochures were developed so as to assist the farmer cooperators and research farms to advertise the trials. A PowerPoint presentation has been prepared that summarizes the goals, results and funding sources for this project. It has already been presented to several groups and will be presented at conferences in the future. More analysis, raw data and index tables on data that is shown is available on request.

f) Project Photos

Photos from project plots and activities are available upon request (several are attached in Appendix C).

g) Acknowledgments

Final reports and presentations prepared from the results of this project will acknowledge the financial support given by Saskatchewan Agriculture and Food.

h) Expense Statement

Total expenses for this project were $121,200. A contribution of $80,000 was made by Saskatchewan Agriculture, Food and Rural Revitalization as well as two disbursements of $10,000 and $8,000 for a total of $18,000 was received from industry.

The following is a table of expenditures that were made to complete this research:

Table 2 - Research Expenditures

	Funds Approved	Actual Expenditures 2003	Actual Expenditures 2004	Actual Expenditures Total
i) Salaries – Professional	$15,000.00	$12,646.75	$25,560.00	$38,206.75
ii) Fees – e.g. Consultants	$6,000.00	$2,999.50	$3,882.00	$6,881.50
iii) Rental Costs	$38,000.00	$14,988.33	$32,407.98	$47,396.31
iv) Materials, Supplies	$6,000.00	$2,819.06	$9,754.46	$12,573.52
v) Project Travel	$6,200.00	$6,678.00	$16,475.92	$23,153.92
vi) Other (shipping)	$15,200.00	$7.15	$40.28	$47.43
vii) Audit Fees	N/A	N/A	N/A	N/A
Total Expenditures	**$86,400.00**	**$40,137.79**	$88,119.76	**$128,258.55**
Industry Financial Contributions	30,800.00	$10,000.00	$8,000.00	$18,000.00
Applicant Contributions	4,000.00			$4,000.00
Approved ADF Contributions	**$86,400.00**			**$86,400.00**
ADF Contributions received		$37,000.00	$43,000.00	$80,000.00
Final Payment due				**$6,400.00**

Explanation for difference in budget vs. actual costs:
Due to unfavorable weather costs of seeding, pulling, turning and baling were underestimated. Biolin staff had problems seeding, pulling, turning and baling in an orderly fashion. Consequently, many trips to the field in separate and unordered manner were necessary. Budgeted costs were thus underestimated in professional salaries, consultant fees, rental costs, materials and travel.
Fuel costs and increased in rental rates for equipment such as trailers, tractors, etc. explain some of the discrepancies in budgeted vs. actual rental costs and project travel. In the original agreement with the Sunshine Textiles Group, their last contribution of $12,800 was to cover the cost of transporting one or more containers of LLFF bales from the field to China where they were to be processed. However, this money was never received, and despite repeated phone calls and emails

over the last eight months Sunshine Textiles have not completed their part of the project. Hence, their industry financial contribution was less than anticipated.

j) ICAR Data Entry

An entry in the ICAR database will be made that corresponds with this report.

Appendix A
Data Tables from Variety Trials

Plant Height with seeds (cm)										
	Abernathy 2004	Canora 2003	Churchbridge 2003	Churchbridge 2004	Indian Head 2003	Melfort 2004	Preeceville 2003	Preeceville 2004	Redvers 2003	Redvers 2004
Argos	75	87	83	55	57	95	84	86	66	75
Arriane	73	80	82	54	58	93	85	92	75	63
CEB0018	70			56		86		75		70
CEB0106	67			49		89		73		78
Diane	80	78	67	62	53	97	84	89	70	66
Diva	71	82	89	52	57	90	74	77	67	73
Elektra	77			66		95		88		60
Elise	74			56		86		80		70
Escalina	76	84	92	60	57	81	79	81	73	72
Evelyn	63			41		79	86	74		73
Flanders	64		64	48		79	72	68		77
Hermes	80			50		94		86		63
Ilona	72			58		87		81		70
Marylin	74	81		65	55	93	76	81	75	67
Venus	69	82		58	56	84	83	83	74	68
Viking	68	75	86	53	52	84	71	77	65	70
Vimy	66	68		56	49	77	72	74	71	68
AVG	72	79	80	55	55	87	79	80	71	70
c.v. (%)	10.7	8.7	13.8	17.5	8.3	7.7	12.0	9.4	8.8	10.9
LSD (5%)	9	8	51	13	7	5	20	7	9	10

Salvaged Straw Yield (kg/ha)										
	Abernathy 2004	Canora 2003	Churchbridge 2003	Churchbridge 2004	Indian Head 2003	Melfort 2004	Preeceville 2003	Preeceville 2004	Redvers 2003	Redvers 2004
Argos	1,337	3,988	2,361	2,420	1,781	4,114	2,179	4,287	1,228	3,712
Arriane	976	2,524	2,256	2,228	1,484	4,163	2,322	4,664	1,596	2,173
CEB0018	1,418			1,934		3,571		3,568		2,903
CEB0106	1,660			1,554		4,833		2,800		4,042
Diane	1,337	3,492	1,344	2,587	1,394	5,036	2,086	4,015	1,842	3,371
Diva	1,294	3,560	2,016	1,998	1,273	4,732	1,749	3,090	1,510	3,586
Elektra	1,412			2,187		5,191		4,696		2,334
Elise	1,267			2,591		4,334		3,706		2,861
Escalina	1,082	2,228	2,130	2,211	1,270	3,834	1,514	3,416	1,802	2,939
Evelyn	738			1,610		3,106	2,356	2,477		3,395
Flanders	999			1,342		2,808	1,922	1,947		3,469
Hermes	1,157			2,419		5,226		3,496		2,441
Ilona	917			2,173		4,516		3,954		3,215
Marylin	1,530	3,129		2,461	1,371	4,937	1,171	3,966	1,862	3,086
Venus	922	3,224		2,401	1,431	4,177	1,922	3,393	2,145	3,055
Viking	891	2,160	1,882	1,726	1,391	3,610	1,393	2,703	1,368	2,936
Vimy	951	2,237		1,944	1,285	2,976	1,327	2,539	1,788	2,612
AVG	1,170	2,949	1,917	2,105	1,370	4,186	1,858	3,454	1,791	3,066
c.v. (%)	28.7	29.7	38.6	31.8	21.6	23.4	42.8	25.0	27.1	24.7
LSD (5%)	370	1,094	3,350	911	491	1,054	1,419	728	683	950

Fiber % On Unretted Straw										
	Abernathy 2004	Canora 2003	Churchbridge 2003	Churchbridge 2004	Indian Head 2003	Melfort 2004	Preeceville 2003	Preeceville 2004	Redvers 2003	Redvers 2004
Argos	23.4	23.5	21.2	26.5	19.5	26.9	22.7	24.8	16.1	26.3
Arriane	21.2	19.5	20.1	23.2	16.7	22.7	20.9	24.7	18.5	23.0
CEB0018	19.3			21.4		22.4		21.4		24.3
CEB0106	21.3			23.9		24.3		22.7		26.3
Diane	21.8	21.9	15.2	25.1	17.1	25.6	21.3	24.4	19.1	24.5
Diva	21.0	23.2	17.0	23.3	16.2	23.9	20.0	23.1	17.5	26.2
Elektra	21.4			24.4		26.0		24.9		24.1
Elise	21.1			23.2		23.0		22.6		24.4
Escalina	21.4	22.6	18.7	23.8	16.5	24.0	23.1	23.2	19.8	24.6
Evelyn	18.2			20.4		20.9	20.4	19.2		26.2
Flanders	17.9			19.8		20.4	18.7	19.4		25.5
Hermes	22.5			26.8		25.5		22.6		23.9
Ilona	20.3			24.1		24.5		22.6		26.0
Marylin	24.1	24.3		25.3	17.8	27.9	23.9	26.0	19.9	23.1
Venus	22.5	24.0		25.0	18.6	26.7	23.1	26.3	19.8	25.0
Viking	20.4	18.3	20.9	22.1	13.2	22.1	20.8	21.0	15.8	23.8
Vimy	18.1	16.4		19.9	14.6	19.8	16.3	19.5	20.4	22.9
AVG	20.9	21.5	18.7	23.4	16.7	23.9	21.0	22.9	18.6	24.7
c.v. (%)	9.3	13.0	16.0	9.7	14.2	10.1	16.2	10.1	13.5	9.7
LSD (5%)	1.5	1.5	12.9	1.7	2.8	1.3	7.0	1.6	3.5	3.5

Fiber Yield (kg/ha)										
	Abernathy 2004	**Canora 2003**	**Churchbridge 2003**	**Churchbridge 2004**	**Indian Head 2003**	**Melfort 2004**	**Preeceville 2003**	**Preeceville 2004**	**Redvers 2003**	**Redvers 2004**
Argos	314	945	516	647	347	1,090	485	1,067	196	976
Arriane	206	492	461	520	250	944	506	1,139	303	500
CEB0018	276			416		801		763		716
CEB0106	352			373		1,175		637		1,066
Diane	295	770	207	651	240	1,289	432	981	361	859
Diva	272	828	349	467	208	1,131	347	714	264	944
Elektra	306			536		1,349		1,166		608
Elise	267			602		997		839		700
Escalina	232	504	426	529	211	920	349	793	359	725
Evelyn	133			328		649	468	474		903
Flanders	179			270		576	392	377		887
Hermes	262			649		1,336		787		591
Ilona	186			525		1,104		894		845
Marylin	368	760		623	246	1,376	281	1,033	373	713
Venus	207	772		601	265	1,117	435	897	432	765
Viking	183	402	395	389	185	805	295	569	219	723
Vimy	173	368		388	191	591	216	502	363	597
AVG	248	649	374	501	238	1,015	389	802	319	772
c.v. (%)	33.2	37.4	51.2	36.5	30.1	29.9	46.2	30.7	36.0	31.7
LSD (5%)	84	259	698	231	101	280	330	175	161	316

Appendix B
Data Tables from Acre Trials

Plant Count per m^2											
Variety	Date Collected	Abernathy 2004	Canora 2003	Churchbridge 2003	Churchbridge 2004	Indian Head 2003	Melfort 2004	Preeceville 2003	Preeceville 2004	Redvers 2003	Redvers 2004
Elektra	08-Sep-04	2,068	961	790	1,528	543	2,282	1,411	2,175	665	1,750
Evelyn	08-Sep-04	2,104	819	688	1,632	604	2,161	1,175	1,449	688	1,979
Hermes	08-Sep-04	1,352	1,088	624	1,797	516	1,738	1,245	1,753	705	2,013
Ilona	08-Sep-04	1,679	1,159	663	1,428	665	2,117	1,271	1,411	721	2,202
Field Average /a		1,801	1,007	690	1,596	582	2,073	1,275	1,706	697	1,994
Standard Deviation		690	344	390	667	249	522	369	760	279	670
c.v.		38.3%	34.2%	56.6%	41.8%	42.8%	25.2%	28.9%	44.5%	40.0%	33.6%
LSD (5%)		734	379	345	778	289	571	446	827	245	776

Plant Height (cm)											
Variety	Date Collected	Abernathy 2004	Canora 2003	Churchbridge 2003	Churchbridge 2004	Indian Head 2003	Melfort 2004	Preeceville 2003	Preeceville 2004	Redvers 2003	Redvers 2004
Elektra	08-Sep-04	60	58	60	73	52	82	74	72	59	73
Evelyn	08-Sep-04	64	73	52	62	45	75	69	71	33	69
Hermes	08-Sep-04	64	71	53	68	47	85	74	78	45	73
Ilona	08-Sep-04	61	79	50	65	43	82	66	72	59	65
Field Average /a		62	70	54	67	47	81	71	73	50	70
Standard Deviation		5	10	12	8	5	6	6	6	12	6
c.v.		8.3%	14.1%	22.0%	12.6%	11.4%	7.6%	8.9%	8.3%	24.8%	9.0%
LSD (5%)		13.0	7.2	10.1	19.6	4.8	12.9	6.2	14.4	6.1	13.9

Fiber % On Unretted Straw (NIR)											
Variety	Date Collected	Abernathy 2004	Canora 2003	Churchbridge 2003	Churchbridge 2004	Indian Head 2003	Melfort 2004	Preeceville 2003	Preeceville 2004	Redvers 2003	Redvers 2004
Elektra	08-Sep-04	22.5%	22.1%	21.3%	24.5%	18.3%	25.6%	23.3%	23.4%	21.7%	28.9%
Evelyn	08-Sep-04	23.3%	26.5%	20.4%	26.8%	18.3%	27.0%	23.9%	24.0%	24.1%	26.7%
Hermes	08-Sep-04	23.4%	21.3%	21.6%	28.6%	18.6%	28.1%	25.8%	25.4%	21.9%	27.3%
Ilona	08-Sep-04	23.4%	22.2%	20.6%	26.4%	19.0%	25.7%	23.3%	24.5%	19.5%	26.1%
Field Average /a		22.7%			25.7%		26.7%		24.6%		27.0%
Standard Deviation		1.4%			2.8%		1.1%		1.5%		1.8%
c.v.		6.1%			10.9%		4.3%		6.0%		6.5%
LSD (5%)		1.5%			2.8%		1.0%		1.6%		1.8%

NOTE: Fiber Contents were not taken on each 1/20 m2 samples gathered from the field in 2003, rather samples were analyzed, joined together and then a NIR fiber content was taken, and thus average, standard deviation , c.v., and LSD can not be calculated due to no replication

Salvaged Straw Yield (kg/ha)											
Variety	Date Collected	Abernathy 2004	Canora 2003	Churchbridge 2003	Churchbridge 2004	Indian Head 2003	Melfort 2004	Preeceville 2003	Preeceville 2004	Redvers 2003	Redvers 2004
Elektra	08-Sep-04	3,011	4,997	4,051	4,168	3,345	8,750	8,067	4,410	4,568	5,791
Evelyn	08-Sep-04	3,953	7,409	3,486	3,364	2,557	7,064	6,025	3,448	2,421	5,689
Hermes	08-Sep-04	2,864	7,925	3,081	4,228	3,569	7,801	6,935	5,763	3,224	6,019
Ilona	08-Sep-04	3,030	7,713	2,748	3,548	3,888	7,302	6,139	4,550	4,244	5,191
Field Average /a		3,215	7,011	3,342	3,827	3,340	7,741	6,791	4,580	3,659	5,662
Standard Deviation		1,284	2,382	2,407	1,525	980	2,009	1,780	1,266	1,754	1,586
c.v.		39.9%	34.0%	72.0%	39.8%	29.3%	26.0%	26.2%	27.6%	47.9%	28.0%
LSD (5%)		1,440	2,461	2,109	1,760	1,008	2,266	1,882	1,152	1,377	1,857

Fiber Yield (NIR) Based On Salvaged Straw (kg/ha)											
Variety	Date Collected	Abernathy 2004	Canora 2003	Churchbridge 2003	Churchbridge 2004	Indian Head 2003	Melfort 2004	Preeceville 2003	Preeceville 2004	Redvers 2003	Redvers 2004
Elektra	08-Sep-04	678.2	1,102.4	862.5	1,020.3	612.3	2,238.0	1,881.3	1,031.4	991.6	1,674.0
Evelyn	08-Sep-04	919.6	1,961.9	712.3	902.9	469.2	1,905.1	1,440.9	828.1	583.3	1,519.6
Hermes	08-Sep-04	670.9	1,687.1	664.8	1,210.5	664.6	2,195.6	1,791.2	1,462.0	707.0	1,646.2
Ilona	08-Sep-04	710.2	1,712.0	567.0	935.0	737.8	1,879.7	1,429.8	1,114.9	827.3	1,355.1
Field Average /a		733	1,616	702	994	621	2,066	1,636	1,126	782	1,541
Standard Deviation		304	569	510	438	185	537	429	326	365	475
c.v.		41.4%	35.2%	72.6%	44.1%	29.8%	26.0%	26.2%	29.0%	46.6%	30.8%
LSD (5%)		338	562	446	504	187	612	450	293	296	551

Seed Yield (kg/ha)											
Variety	Date Collected	Abernathy 2004	Canora 2003	Churchbridge 2003	Churchbridge 2004	Indian Head 2003	Melfort 2004	Preeceville 2003	Preeceville 2004	Redvers 2003	Redvers 2004
Elektra	08-Sep-04	462	493	497	881	624	1,243	708	372	563	1,503
Evelyn	08-Sep-04	529	784	456	595	397	1,042	773	265	272	1,432
Hermes	08-Sep-04	493	1,049	375	578	764	1,223	765	440	449	1,327
Ilona	08-Sep-04	588	560	295	693	736	989	705	593	630	1,385
Field Average /a		518	722	407	687	630	1,126	738	423	492	1,410
Standard Deviation		318	351	438	369	227	481	241	241	284	573
c.v.		61.4%	48.6%	107.7%	53.7%	36.0%	42.7%	32.6%	57.0%	57.7%	40.6%
LSD (5%)		375	326	386	415	208	578	284	269	224	680

Appendix B
Photos from Trials